



October 20, 2011

L-2011-454  
10 CFR 50.73

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D.C. 20555

Re: St. Lucie Unit 1  
Docket No. 50-335  
Reportable Event: 2011-001  
Date of Event: August 22, 2011

Unit 1 Manual Reactor Trip Due To High Condenser Backpressure Caused by Severe  
Influx of Jellyfish into the Intake Structure

The attached Licensee Event Report 2011-001 is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Very truly yours,

Richard L. Anderson  
Site Vice President  
St. Lucie Plant

RLA/dlc  
Attachment

IE  
1

<b>NRC FORM 366</b> (10-2010)		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>		APPROVED BY OMB: NO. 3150-0104		EXPIRES: 10/31/2013			
<b>LICENSEE EVENT REPORT (LER)</b>				Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.					
<b>1. FACILITY NAME</b> <div style="text-align: center;">St. Lucie Unit 1</div>				<b>2. DOCKET NUMBER</b> <div style="text-align: center;">05000335</div>		<b>3. PAGE</b> <div style="text-align: center;">1 OF 3</div>			
<b>4. TITLE</b> Unit 1 Manual Reactor Trip Due To High Condenser Backpressure Caused by Severe Influx of Jellyfish into the Intake Structure									
<b>5. EVENT DATE</b>			<b>6. LER NUMBER</b>			<b>7. REPORT DATE</b>			
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	
08	22	2011	2011 - 001 - 00			10	20	2011	
<b>8. OTHER FACILITIES INVOLVED</b>									
FACILITY NAME			DOCKET NUMBER						
FACILITY NAME			DOCKET NUMBER						
<b>9. OPERATING MODE</b>  <div style="text-align: center;">1</div>			<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)</b>  <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"><input type="checkbox"/> 20.2201(b)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(3)(i)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(C)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(vii)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2201(d)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(3)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(viii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(1)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(4)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ii)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(viii)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(i)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(1)(i)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(iii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ix)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(1)(ii)(A)</div> <div style="width: 50%;"><input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(x)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(iii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(2)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 73.71(a)(4)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(iv)</div> <div style="width: 50%;"><input type="checkbox"/> 50.46(a)(3)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 73.71(a)(5)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(v)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(C)</div> <div style="width: 50%;"><input type="checkbox"/> OTHER</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(vi)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(D)</div> </div> <div style="text-align: right; font-size: x-small;">Specify in Abstract below or in NRC Form 366A</div>						
<b>12. LICENSEE CONTACT FOR THIS LER</b>									
NAME <div style="text-align: center;">Don Cecchett</div>						TELEPHONE NUMBER (Include Area Code) <div style="text-align: center;">772-467-7155</div>			
<b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>									
CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU- FACTURER	REPORTABLE TO EPIX
X	SG	COND	-	NO	C	NN	Travel Screen	-	YES
X	SJ	Feedwater	-	NO					
<b>14. SUPPLEMENTAL REPORT EXPECTED</b>						<b>15. EXPECTED SUBMISSION DATE</b>			
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)						<input checked="" type="checkbox"/> NO			
						MONTH	DAY	YEAR	
<b>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</b>  <p>On August 22, 2011, St. Lucie Unit 1 was operating in Mode 1 at 89% when it was manually tripped due to rising condenser back pressure. All control element assemblies (CEAs) fully inserted into the core. The cause of the rising back pressure was an influx of jelly fish into the intake structure degrading Unit 1 circulating water system performance. Decay heat removal was initially from the main feedwater and steam bypass to the main condenser. However, subsequent to the manual trip, the 1B main feedwater pump was manually secured due to a leak on the pump casing. The 1A main feedwater pump subsequently tripped due to low suction pressure after manually securing the 1B condensate pump and decay heat removal was transitioned to the atmospheric dump valves and auxiliary feedwater.</p> <p>Root cause evaluation determined the jellyfish intrusion rate exceeded the current capacity of the traveling water screens and trash pits. In addition, procedural guidance did not anticipate the possible rapidly escalating jellyfish intrusion rate and the urgency for response regarding the negative effect of the rapid jelly intrusion on condenser back pressure was not recognized.</p> <p>Contributing causes included: plant maneuvering did not account for condenser back pressure margin, equipment degradation and malfunctions, and design deficiencies.</p> <p>Corrective actions include procedure revisions and design changes to address procedure deficiencies and correct design deficiencies.</p>									

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

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**NARRATIVE****Description of the Event**

On August 22, 2011, St. Lucie Unit 1 was operating at 89% when it was manually tripped due to rising condenser [EIIS: COND] back pressure caused by an influx of jelly fish into the intake structure degrading the circulating water system performance. All CEAs [EIIS: ET] fully inserted into the core. Decay heat removal was initially from the main feedwater and steam bypass to the main condenser but was subsequently secured due to a leak on the 1B MFP pump casing. Decay heat removal was transitioned to the atmospheric dump valves [EIIS:RV] and auxiliary feedwater.

**Cause**

The severe influx of the jellyfish intrusion rate exceeded the current capacity of the traveling water screens and trash pits. The intake system and structure were unable to remove debris efficiently enough to avoid increased traveling screen differential pressure which led to increased condenser backpressure, resulting in the manual trip of the unit. Design of the intakes is the same for Unit 1 and 2 with the exception of the trash/weir pits whose purpose is to collect debris from the traveling water screen baskets that are carried up above the operating floor where it is removed by a series of sprays and emptied into a trash (or weir) pit. The design of the weir pits differ in that Unit 1 has 2" diameter holes in the side of the weir pit to allow for water equalization and debris entrapment, while Unit 2 has large windows below the water line allowing debris recirculation. Additionally, the Unit 1 weir pit is located out in front of the intake structure while the Unit 2 weir pit is located just beside the intake structure.

Contributing causes included; 1) the urgency for response and the potential for the rapid jellyfish intrusion rate affects on condenser backpressure margin on Unit 1 were not recognized, 2) equipment degradation and malfunctions resulted in an increase in susceptibility and a reduction in operational margin and 3) previously identified intake structure / equipment design deficiencies limited the capability to mitigate the jellyfish intrusion.

**Analysis of the Event**

The severe influx of jellyfish into the intake structure created high traveling screen differential pressures (D/Ps), causing Unit 1 to commence a rapid down power in accordance with plant procedures. Following the downpower and the throttling of the circulating water pump discharge valves, the 1A2 traveling screen tripped and D/P across the 1A2 traveling screen exceeded 40" H2O requiring the 1A2 circulating water pump to be secured. Condenser backpressure increased to the manual trip set point and the Unit 1 reactor and turbine were manually tripped.

Subsequent to the manual trip, a leak developed on the 1B main feed pump (MFP) casing and the 1B MFP was secured. During the performance of the secondary plant post trip actions, the 1B condensate pump was secured and an unexpected trip occurred on the 1A MFP due to low suction pressure. The 1A MFP trip was due to the 1B condensate pump discharge check valve failing to close creating reverse flow and a reduction in suction pressure. Auxiliary feedwater was manually started and restored steam generator water level to normal. Since main feedwater was unavailable following the plant trip while in the post-trip response emergency operating procedure (EOP) network, the trip was an unplanned scram with complications.

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## NARRATIVE

**Analysis of Safety Significance**

All safety related systems functioned as designed. The plant response to the event was a manual reactor trip due to high backpressure-low vacuum. The automatic turbine vacuum trip set point was never reached and conservative measures were taken before reaching automatic set points. The plant was not at full power when the events occurred and a complete loss of condenser cooling did not occur. There were no safety system actuations as a result of the trip. Given the response of the plant and actions taken, the health and safety of the public was not affected by this event.

Over a period of 24 hours upon reactor trip, the conditional core damage probability (CCDP) and conditional large early release probability (CLERP) would reach  $1.81\text{E-}09$  and  $1.55\text{E-}11$ , respectively. These values are significantly below the threshold required by Regulatory Guide 1.174 for the risk to be "small" where CDP is below  $1.0\text{E-}06$  and LERP is below  $1.0\text{E-}07$ .

This event is reportable under the requirements of 10 CFR 50.73(a)(2)(iv)(A) due to manual reactor protection system (RPS) actuation.

**Corrective Actions**

The corrective actions and supporting actions listed below are entered into the site corrective action program. Any changes to the actions will be managed under the corrective action program.

1. Revise the circulating water off normal procedures to establish that the station will conduct a pre-emptive rapid downpower to the affected unit(s) in the event of a jellyfish, sea grass, or intake intrusion event that is occurring and meeting the specific criteria.
2. Implement a design change to both St. Lucie units to upgrade existing traveling water screens to increase the capacity to help prevent future unplanned downpowers due to jellyfish and sea grass intrusion.
3. Revise the intake intrusion monitoring and mitigation procedural guidance to include additional mitigation equipment checks and revise the threat assessment guideline to update action levels and response direction to reflect risk levels associated with the intrusion rate.

**Similar Events**

A search was performed using an industry database from 2006 to present. Results identified five events similar to the circumstances of this jellyfish intrusion event. A similar theme was challenges to traveling water screens required the tripping of circulating water pumps and down powering or tripping of the unit as a result of the decreased flow of circulating water. Common corrective actions included procedure upgrades to reflect risk and actions to mitigate such a threat, increased monitoring and sampling.

**Failed Components**

1B main feed pump  
1B condensate pump discharge check valve  
1A2 traveling water screen